

Limiting and Excess Reagents.

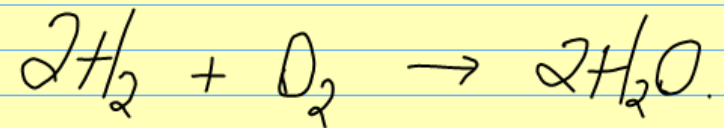
A reagent is a name for a chemical that is used as a reactant in a chemical reaction. The limiting reagent is the reactant that is completely used up in a chemical reaction. At that point the reaction stops. The other reactant will not be completely used up and will have some left over. This is the excess reagent.

Stoichiometry is used to calculate which reagent is limiting and which is in excess. To do this we follow these steps:

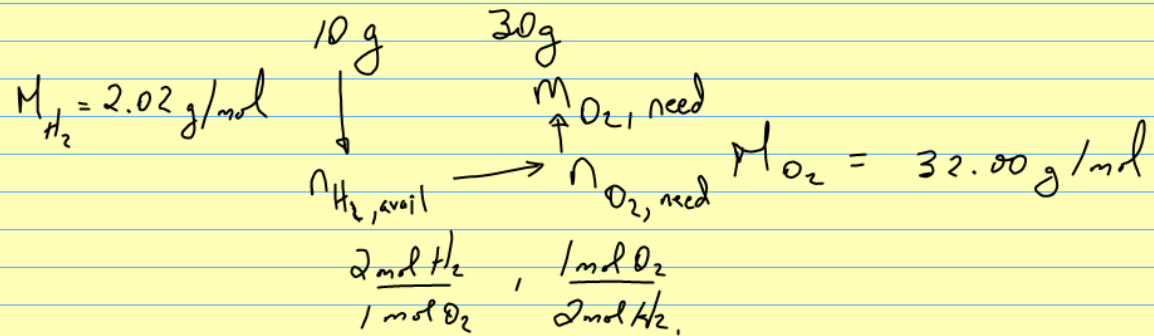
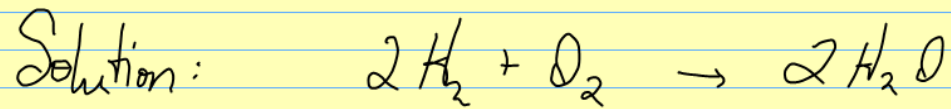
- ① Select one of the reactants and calculate how many moles are available.
- ② Use the moles of the selected reactant to calculate how many moles of the other reactant are needed.

- ③ The needed mass of the other reactant can be calculated from the number of moles.
- ④ The needed mass can be compared with the amount available. If there is more than needed it the excess reagent. If there is less than needed it is the limiting reagent.

Example: Water can be made by burning hydrogen gas in oxygen gas:



If 10g of hydrogen gas is burned using 30g of oxygen gas, which is the limiting and excess reagent.



$$n_{\text{H}_2, \text{avail}} = 10 \text{ g} \times \frac{1 \text{ mol}}{2.02 \text{ g}} = 4.95 \text{ mol}$$

$$n_{\text{O}_2, \text{need}} = 4.95 \text{ mol H}_2 \times \frac{1 \text{ mol O}_2}{2 \text{ mol H}_2} = 2.48 \text{ mol O}_2$$

$$m_{\text{O}_2, \text{need}} = 2.48 \text{ mol O}_2 \times \frac{32.00 \text{ g}}{1 \text{ mol}} = 79.2 \text{ g}$$

$$m_{\text{O}_2, \text{need}} > m_{\text{O}_2, \text{avail}}$$

\therefore oxygen is the limiting reagent

\therefore hydrogen is the excess reagent

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